(No Model.) 3 Sheets—Sheet 1.

W. MAIN.

ELECTRICALLY PROPELLED VEHICLE.

No. 417,259. Patented Dec. 17, 1889.

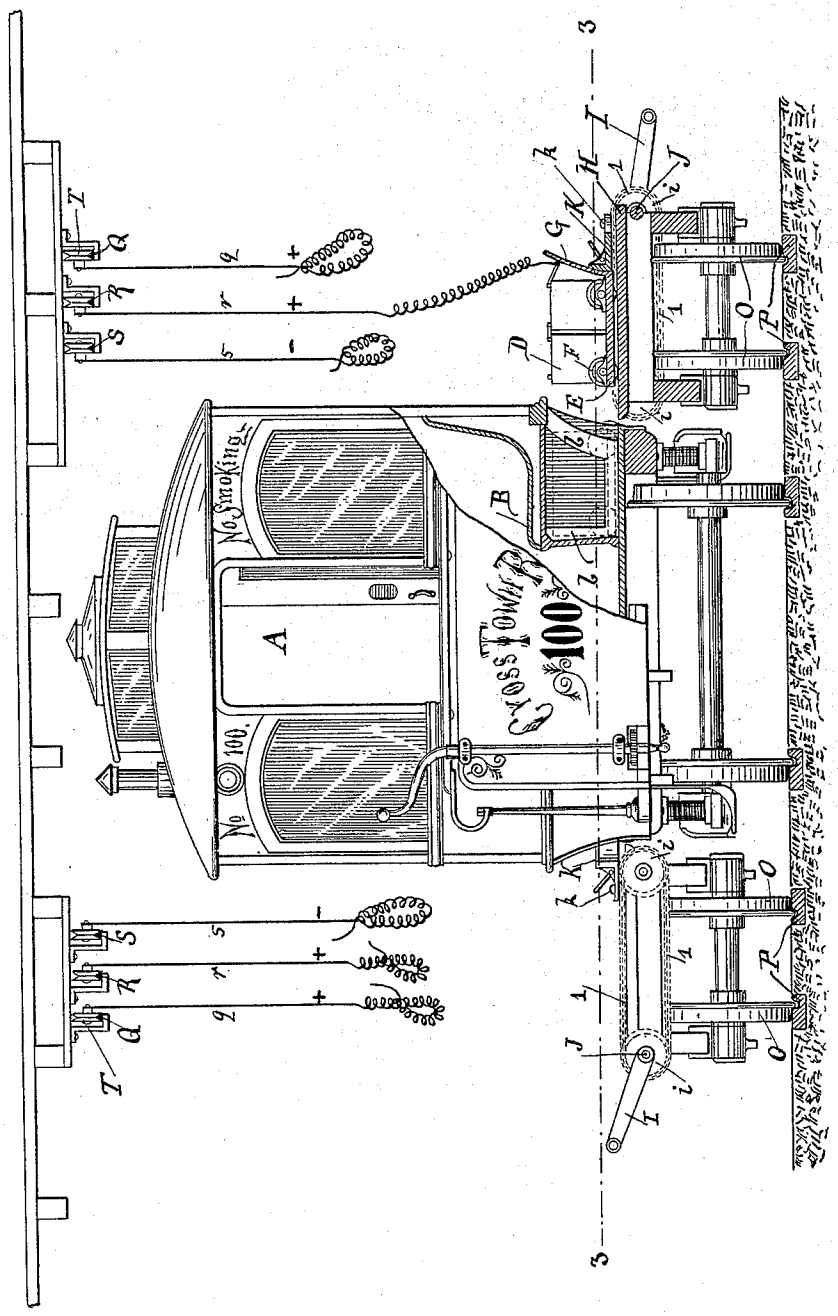


Fig. 1.

Witnesses
J. J. Kennedy
E. M. Borst

Inventor
William Main
By his Attorneys Philipp Phillips & Young

N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

W. MAIN.

ELECTRICALLY PROPELLED VEHICLE.

No. 417,259. Patented Dec. 17, 1889.

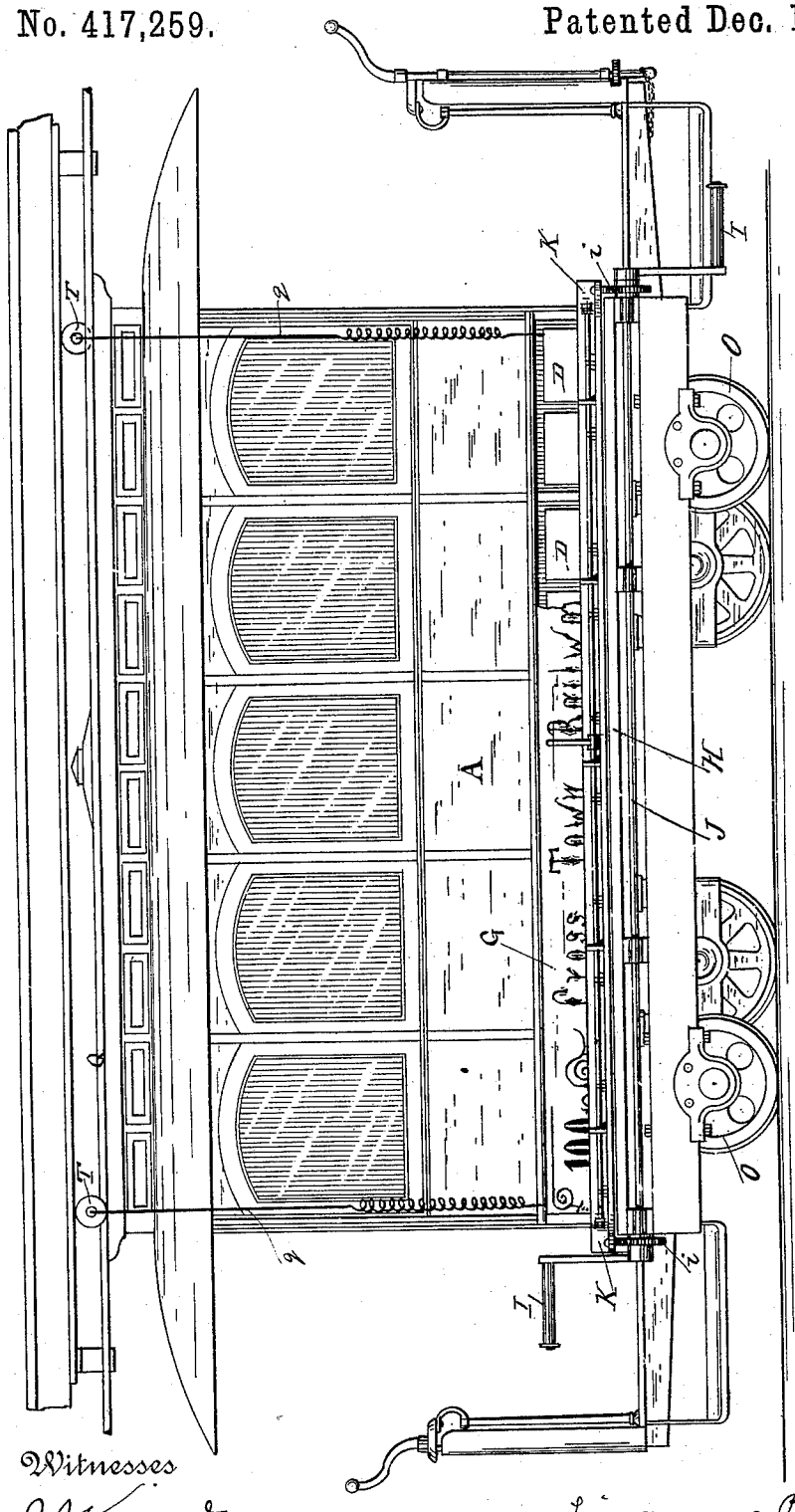


Fig. 2.

Witnesses
J. J. Kennedy
Ernest Bond

Inventor
William Main
By his Attorney Philip Phelps & Son

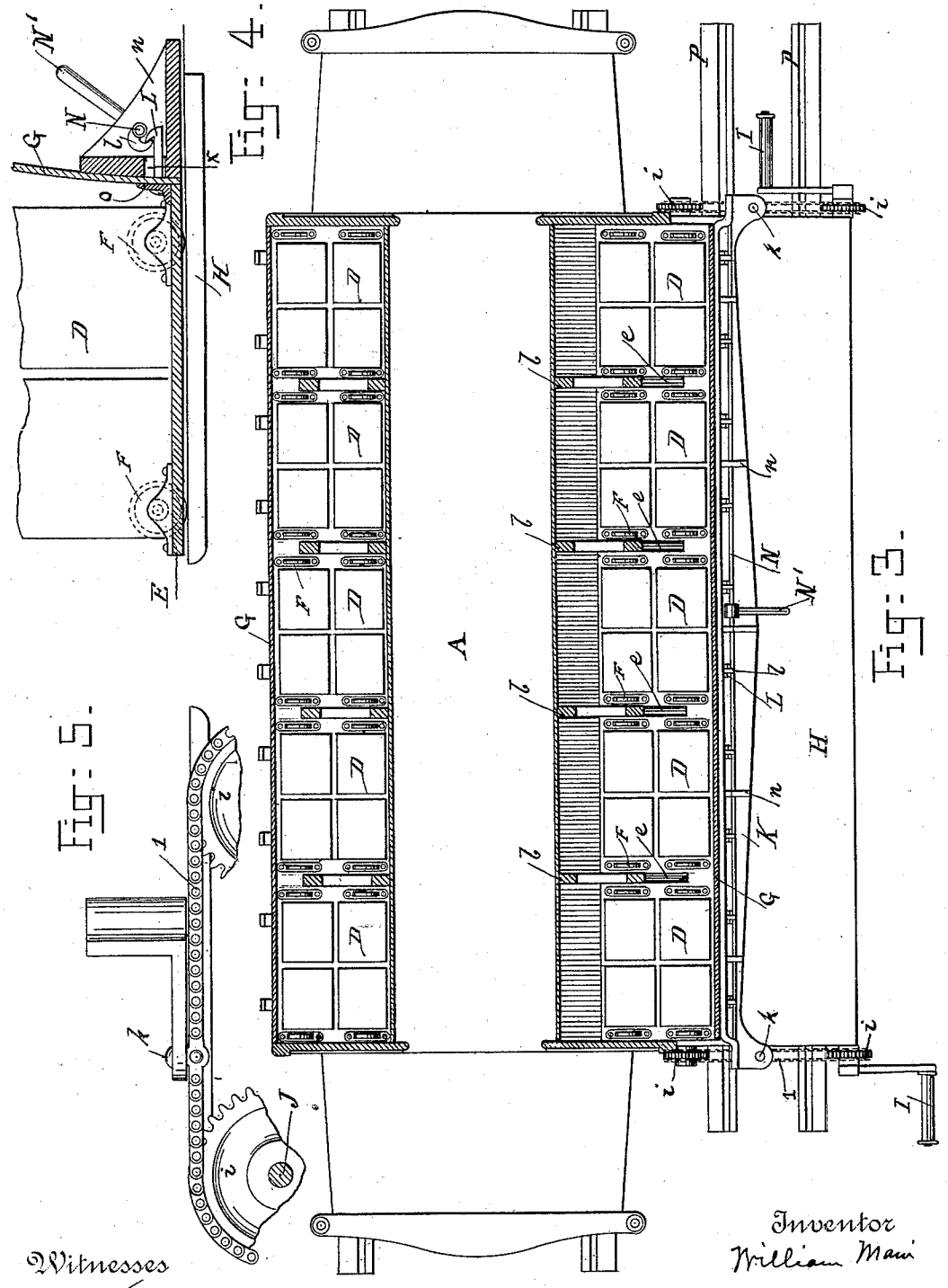
N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 3.

W. MAIN.

ELECTRICALLY PROPELLED VEHICLE.

No. 417,259. Patented Dec. 17, 1889.



Witnesses
J. J. Kennedy
J. M. Bowes

Inventor
William Main

By his Attorneys Philipp Phelps & Hovey

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM MAIN, OF BROOKLYN, NEW YORK.

ELECTRICALLY-PROPELLED VEHICLE.

SPECIFICATION forming part of Letters Patent No. 417,259, dated December 17, 1889.

Application filed May 23, 1889. Serial No. 311,811. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM MAIN, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Appliances for Electrically-Propelled Vehicles, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of my invention is to provide a construction of street-car and apparatus whereby the loading and unloading of storage-batteries thereupon and therefrom may be rendered expeditious and easy.

Storage-batteries being bulky and heavy, difficulty has been experienced in replacing them when exhausted without either an undesirable delay and waste of time or the assistance of a considerable force of employés.

My invention makes it possible for two persons to operate a charging-station for a large number of cars with expedition; and it consists in certain apparatus and features of construction which may be more readily described in connection with the drawings forming part of the specification, in which—

Figure 1 is an end view of a car and battery-trucks, partly in section. Fig. 2 is a side view of the same. Fig. 3 is a sectional view on the line 3 3, Fig. 1. Fig. 4 is a section of the battery-supporting tray on a large scale, and Fig. 5 represents on an enlarged scale a part of the apparatus for moving the batteries to and from the car.

The car A is of usual construction, and has beneath its seats B the usual spaces for the reception of the batteries D.

Hitherto it has been usual to take the batteries from the car singly or in small groups—a process requiring too much time. That all the batteries of one set may be removed at once, I provide the car with a movable panel G, extending lengthwise of the battery-spaces. I connect the several battery-cells of the set to this panel, preferably by means of a false bottom or tray E, upon which the batteries rest, and through suitable slots in which pass rollers F, journaled upon the tray, and which support the weight of the batteries and roll upon the floor of the car. The panel G is attached to the tray E, and when the panel is removed from the car the batteries and tray are carried with it.

In order that the tray E may enter the car, it is provided with slots *e*, (see Fig. 3,) which receive the stanchions *b*, supporting the seats and upper frame-work.

I desire to call particular attention to the advantages of connecting the battery-cells with the removable panel. It dispenses with the inconvenient necessity of opening a door in order to gain access to the batteries. Such a door would also be in the way when in its open position. It also makes it possible to remove and replace the entire set of cells at once, securing a saving of time. These advantages result from the connection of the cells with the removable panel and do not depend upon any particular form of that connection. I do not, therefore, limit myself to such a connection made by the use of a tray, but intend to include all constructions in which the batteries are connected with the removable panel, so as to be drawn out from the car with it. Other connections may be substituted for the false bottom or tray. So, too, the tray may be made in several sections as well as in a single piece.

To receive the batteries when taken from the car and to support them when presented to the car, I provide a platform H, preferably of the same height as the floor of the car and extending lengthwise of the car and in close proximity thereto when the car is in its position for exchanging batteries.

As a means for readily moving the panel and batteries and tray E to and from the car, I preferably adjust to this platform two or more endless chains 1, each of the chains running over sprocket-wheels *i*. Two of these wheels *i* are provided with cranks I, and are preferably mounted upon a crank-rod J, running the length of the platform and journaled in it. As many of these chains and sets of sprocket-wheels may be employed as are desired. I find that two sets—one at each end of the platform—are sufficient. In order to utilize these chains as a means for moving the batteries to and fro, any convenient devices for forming a temporary connection between them and the panel G or tray E may

be employed. One form of such connections of the many which might be devised, and which would constitute an equivalent of mine, consists of a stringer K, extending from end to end of the platform and attached at each end in any convenient manner, as by a bolt *k*, to the chains 1. This stringer is preferably of angle-iron of the shape shown, but may be of any other suitable form or material. This stringer rests upon the platform, and is moved to and fro by the movement of the chains, and the latter are in turn moved by the rotation of the crank-arms. The inner face of the stringer K is shaped to fit the outer edge of the panel G, so that when the chain moves toward the car the tray will be pushed by the stringer in that direction. A bearing for applying power to the tray is thus afforded along its entire length, and the tray can be made lighter than would be possible if the strain were applied at several points only—as, for instance, at each end.

To provide a connection between the panel or the tray and the chains, whereby the latter may be utilized in withdrawing the batteries from the car, temporary connections are provided, which may be of any suitable construction, the form shown herein consisting of interlocking catches L, projecting from the tray or panel, and catches *l*, attached to the stringer K. Catches *l* are preferably mounted upon a shaft N, journaled in webs *n* of the stringer, the shaft being provided with a handle N′, by means of which all the catches *l* may be raised out of engagement with the catches L. Openings *x* are provided in the rear upright portion of the stringer K to permit the entrance of catches L. The inner ends of the catches L may be supported in a re-enforcing angle-iron *o*. It will be noticed that the connection between the catches L and *l* is effected automatically on pushing the stringer up against the side of the car while the disconnection is effected by a slight rotation of the shaft N through pressure on the handle N′. All, then, that is required in order to transfer a set of batteries from the platform, to the car, or from the car to the platform, is to make the proper connection between the stringer and the panel or tray and rotate the crank-shaft in the proper direction, which is quickly and readily accomplished by two men.

As the car while the process of exchanging batteries is proceeding is without means of independent locomotion, it is desirable to provide convenient apparatus for moving away the exhausted batteries and bringing up charged batteries, and to this end I prefer to mount the platform H upon trucks or rollers O, and to provide tramways P alongside of the car-track, upon which they may be readily pushed by one or two men. I do not confine myself to this means of moving the platforms H to and from a position in proximity to the car, as other devices—such as traveling chains or belts—might readily be devised which would to a certain extent be equivalents of the means described. The exhausted batteries having been drawn out of the car and placed upon the platform, the latter will be rolled away to a position in which the charging-wires are accessible. A truck loaded with freshly-charged batteries will be rolled up. These will be transferred to the car and the latter will proceed upon its trip. It will of course be necessary to have a number of the trays E and panels G interchangeable with the several cars of the system, so that those which are taken out of each car with the exhausted batteries may be returned to another car with the same batteries when charged. It will be desirable to recharge the exhausted batteries while in position upon their trucks and without removing them from the trucks, though these features are not essential to the system.

My invention further includes a novel arrangement of charging-wires, consisting of conductors Q R S, preferably suspended from the ceiling and supporting trolleys T, rolling on these conductors, to which are in turn attached depending wires *q r s*. This form of conductor, with trolley rolling thereon, permits the charging-wires to be shifted from point to point and thus brought near the set of batteries to be charged. The conductors Q R S preferably run in the direction of and immediately over the tramways P.

While I have shown the charging-wires arranged in sets of three, no particular number is requisite. I prefer to use as many as three, one of them being a common return-wire and the other two differing in potential. With such connections the batteries may be charged to greater advantage than when there is but one charging-circuit, the circuit of lower potential being first used and the circuit of higher potential being resorted to when the batteries have acquired a considerable potential by reason of their charge, which has to be overcome. Otherwise it would be necessary to use a resistance in circuit during the first part of the charging operations to reduce the potential of the charging-current or to divide the battery into sections to receive the latter part of the charge, either of which methods is wasteful.

Three or more grades of potential as well as two may be used, if desired.

The several improvements shown herein may be used together as parts of a single system or separately as parts of other systems.

Having thus described my invention, what I claim is—

1. The combination of the car having a space for batteries, a removable panel closing the space through which the batteries are introduced, and a number of separate battery-cells connected to the panel and removable with it, substantially as described.

2. The combination of the car having a space for batteries, a removable panel closing the space through which the batteries are in-

troduced, a number of separate battery-cells, and means for connecting the cells with the panel, substantially as described.

3. The combination of the car having a space for batteries, a removable panel closing the space through which the batteries are introduced, a number of separate battery-cells, and a tray supporting the battery-cells and connected to the panel, substantially as described.

4. The combination, with the car, of the false bottom or tray for supporting the batteries, provided with slots *e* for receiving the stanchions supporting the seat and upper frame-work, substantially as set forth.

5. The combination, with the car having a space for batteries, of a false bottom or tray for supporting said batteries and removable from the car, and a panel for closing the opening through which the batteries and tray are introduced, the panel being attached to the tray, substantially as set forth.

6. The combination of a number of cars, one or more sets of storage-batteries for each car, a set of supporting-trays, one for each set of batteries and removable therewith from the cars, and removable panels attached to said trays, said trays and panels being interchangeable between the several cars of the system, substantially as set forth.

7. The combination, with a storage-battery car, of a platform adjacent to the car in its position for exchanging batteries, and provided with endless chains and cranks for rotating the same for giving motion to the batteries to and from the car, and means for temporarily connecting the chains and batteries, substantially as set forth.

8. The combination, with a storage-battery car provided with a space for receiving the storage-batteries in sets, a tray for supporting the storage-batteries in the car and removable therefrom, a platform for receiving the exhausted batteries from the car and presenting newly-charged batteries to the car, endless chains provided with cranks for giving motion to the same, and connections between the chains and tray, whereby the batteries may be moved in sets to and from their position in the car, substantially as set forth.

9. The combination of the platform H, chains 1, and the stringer K, whereby the batteries may be forced into the car, substantially as set forth.

10. The combination of the platform H, chains 1, the stringer K, tray E, and means for temporarily attaching the stringer to the tray, substantially as set forth.

11. The combination of the tray E, stringer K, the hooks L, attached to the tray, the hooks *l*, attached to the stringer, and the shaft M, for engaging and disengaging the hooks, substantially as set forth.

12. A truck for loading and unloading storage-batteries upon a car, consisting of a platform, in combination with means for moving the platform to and fro parallel with the car-track, and devices carried by the platform for moving the batteries to and from the car, substantially as set forth.

13. A truck for loading and unloading storage-batteries upon and from a car, having in combination a platform, supporting-wheels for moving the platform to and fro, a track for the platform parallel with the car-track, and devices carried upon the platform for moving the storage-batteries to and from the car, substantially as set forth.

14. The combination of a railway-track, a set of storage-battery cars, a set of charging trucks and tramways at the charging-station adjacent to and parallel with the car-track, upon which the battery-trucks may be brought up to and taken away from the cars for the purpose of changing the batteries thereof, substantially as set forth.

15. The combination of a railway-track, a set of storage-battery cars, a set of battery-changing platforms, and means for moving the platforms to and from a position alongside of the car for the purpose of exchanging exhausted for fresh batteries, substantially as set forth.

16. At a charging-station, a plant for charging batteries, consisting of two, or more circuits of different potentials and terminals for the same, whereby the different circuits may be applied successively to the batteries, substantially as set forth.

17. The charging-plant consisting of conductors Q R S, trolleys T, and terminal wires *q r s*, whereby the charging-terminals may be moved to accommodate them to the position of the batteries to be charged, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM MAIN.

Witnesses:
J. J. KENNEDY,
G. M. BORST.